BY THE COMPTROLLER GENERAL

Report To ~~The Honorable Vic Fazio~~ House Of Representatives

OF THE UNITED STATES

Status Of Air Force Efforts To Deal With Groundwater Contamination Problems At McClellan Air Force Base

Since 1979, McClellan Air Force Base has been studying groundwater contamination problems at the base. At the request of Congressman Vic Fazio, GAO reviewed a key July 1983 study prepared by an Air Force contractor aimed at identifying and evaluating suspected problems associated with past hazardous waste disposal sites at McClellan.

GAO found that (1) the study has been criticized by regulatory agencies for not adequately addressing the magnitude and extent of the base's environmental contamination problem and (2) these agencies had limited participation during the study. The Air Force has initiated actions to correct most of the deficiencies in the study. Future efforts at McClellan will include more involvement by state and local regulatory agencies.

Although current tests indicate that the base's water generally meets the state's drinking water criteria, GAO believes more work may be warranted to substantiate the safety of McClellan's drinking water.

UNITED STATES GENERAL ACCOUNTING OFFICE

GAO/NSIAD-84-37
NOVEMBER 22, 1983

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

B-213706

The Honorable Vic Fazio
House of Representatives

Dear Mr. Fazio:

In response to your request, this report provides our evaluation of the Air Force's efforts to control contamination of groundwater at McClellan Air Force Base.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of the report. At that time, we will send copies to the Chairmen, House Committee on Government Operations, Senate Committee on Governmental Affairs, and House and Senate Committees on Appropriations; the Director, Office of Management and Budget; the Secretaries of Defense and Air Force; and other interested parties.

Sincerely yours,

Charles A. Bowsher

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE HONORABLE
VIC FAZIO
HOUSE OF REPRESENTATIVES

STATUS OF AIR FORCE EFFORTS TO DEAL WITH GROUNDWATER CONTAMINATION PROBLEMS AT MCCLELLAN AIR FORCE BASE

D I G E S T

In response to Congressman Vic Fazio's July 19, 1983 request, GAO reviewed Air Force actions relating to groundwater contamination at McClellan Air Force Base near Sacramento, California. The contamination at McClellan has resulted from the dumping of chemicals (such as solvents) over many years. GAO was asked to (1) review the adequacy of a report (known as the Phase II report) prepared for McClellan that was supposed to determine the extent of McClellan's contamination problems and suggest ways to correct them and (2) identify Air Force procedures for releasing contamination data and reports to the public. GAO also looked into Air Force actions to improve its program for resolving hazardous waste pollution problems and McClellan's procedures for insuring its water is safe to drink. (See p. 3.)

GAO's evaluation of the Air Force's efforts to control contamination at McClellan disclosed that

--more work may be warranted to substantiate the safety of McClellan's drinking water. (See pp. 30 to 42.)

--the Phase II study did not adequately determine the magnitude and extent of the base's environmental contamination

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problem[1], and did not make recommendations to clean up the environment (see pp. 8 to 16.), and

--Air Force procedures have been modified to provide more timely release of contamination data and information to regulatory agencies and to the public. (See pp. 28 and 29.)

GAO believes that the Air Force's program for solving hazardous waste pollution problems will be strengthened by recent changes in policies and procedures governing (1) involvement of and coordination with regulatory agencies and (2) responses to contamination problems in off-base areas.

MORE WORK WARRANTED TO SUBSTANTIATE THE SAFETY OF MCCLELLAN'S DRINKING WATER

In late 1979, McClellan AFB officials discovered that the base's drinking water was contaminated with volatile organic compounds. One of these compounds, the suspected carcinogen trichloroethylene (TCE), was present at

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[1]Because GAO did not have the expertise to make a technical evaluation of the Phase II report to determine its adequacy, it used the technical evaluations of the responsible state and local regulatory agencies--the California Regional Water Quality Control Board, the State Water Resources Control Board, the Sanitary Engineering and Hazardous Waste Management branches of the California Department of Health Services, and the County of Sacramento Health Department. At GAO's request, the EPA's Office of Solid Waste and Emergency Response also made a technical review of the Phase II report. Although the office's comments have been incorporated into the GAO report, the office cautioned that its evaluation did not represent the official position of EPA. In addition, it indicated that considerable more effort would be required to thoroughly analyze and understand all the material that was provided in the Phase II report.

concentration levels that, according to the California Department of Health Services, pose an unacceptable health risk to those drinking the water for extended periods of time. Although this condition persisted until August 1980 (and to a much lesser degree until July 1981), base officials did not advise the Department of Health Services or individuals drinking the water of this potential health risk because they (1) did not think the contamination levels were high enough to represent a significant health risk, (2) did not want to create a panic situation and, (3) considered the state's criteria for TCE to be an unofficial guideline. (See p. 30.)

McClellan has reduced contamination levels substantially since November 1979 by taking four contaminated wells out of the base's water distribution system. Test results indicate that the base's water has generally met the state's drinking water criteria since July 1981. However, GAO found that

--the base's water tests did not cover many of the hazardous contaminants identified in the Phase II study, because regulatory requirements did not require testing for some contaminants,

--testing levels used to detect one of the contaminants were higher than the state's criteria,

--safe drinking water criteria has not been established by either the state or the Environmental Protection Agency for some of the contaminants that have been identified in the base's water, and

--McClellan recently discovered that its water contains metals at concentrations that exceed state and EPA standards.

GAO believes that expanded and improved testing procedures may be warranted to substantiate the safety of McClellan's drinking water. (See p. 42.)

STATUS OF THE INSTALLATION RESTORATION PROGRAM

The Installation Restoration Program is a Department of Defense program, started in 1975 by the Army, to (1) identify and evaluate suspected problems associated with past hazardous waste disposal sites at military bases and (2) control the migration of hazardous environmental contamination from these sites. The program is divided into four phases. McClellan has completed the first two phases and has begun Phase III and IV work. (See pp. 1 through 3.)

Phase I, a records search designed to identify and prioritize past hazardous waste disposal sites that might pose a threat to public health or the environment, was completed in July 1981. The Phase II report, a confirmation study of the sites to determine the types and quantities of contaminants, was issued in July 1983. Phase III develops a technical base upon which to prepare a comprehensive contaminant control plan for problems requiring remedial action. Phase IV is the operations phase which includes the design, construction, and operation of pollution abatement facilities, and the completion of remedial actions. (See pp. 1 through 6.)

As of October 14, 1983, McClellan had awarded two Phase III contracts, one to do further work on solving the contamination problem in one of the most polluted areas on the base. The second contract is to develop methods for sealing base water wells so that contaminated shallow groundwater will not enter the deeper aquifers (underground layers of porous rock, sand, or gravel) from which the base gets its drinking water. (See pp. 6.)

McClellan has undertaken two projects in the Phase IV category. In 1981 they removed the polycholrinated byphenyl (a hazardous chemical) contamination from a recently purchased site. In addition, it is currently removing liquid sludge from one of the disposal pits. Phase IV clean up work will continue for

several years. An estimated $29 million will be needed for fiscal years 1984 through 1987. (See pp. 1 through 6.)

REGULATORY AGENCIES DO NOT BELIEVE THE PHASE II REPORT ACCOMPLISHED ITS OBJECTIVES

To accomplish Phase II at McClellan, the confirmation study to define and quantify the existence of contamination, the Air Force contracted with Engineering-Science, Inc. for a study and report that was supposed to (1) determine the magnitude and extent of contamination which has resulted from previous waste disposal practices, (2) make recommendations for actions to mitigate adverse environmental effects of existing contamination problems, (3) suggest potential ways of restoring the environment to as near a normal level as is practical, and (4) suggest a future environmental monitoring program to document environmental conditions. (See p. 8.)

However, the contractor that conducted the study for the Air Force, after analyzing the data that was developed, concluded that cleanup measures were either prohibitively costly or ineffective. As a result, the final Phase II report did not recommend any cleanup actions but, instead, concentrated on measures to limit the adverse environmental effect of the existing contamination problem. For example, the contractor recommended capping disposal sites rather than removing the contaminated soil. (See p. 8.)

In view of the conclusions consistently arrived at by state and local regulatory agencies and the preliminary assessment of the Environmental Protection Agency's Office of Solid Waste and Emergency Response, GAO believes (1) the Phase II study for McClellan did not adequately determine the magnitude and extent of the base's environmental contamination problem and (2) additional information is needed before appropriate corrective actions can be developed. A similar view was expressed by the Phase III contractor doing site closure work in one of the most contaminated areas on the base. Specifically, the regulatory agencies, the Phase III contractor, and the preliminary EPA assessment

--pointed out that the Phase II study did not determine the amount and type of wastes in the disposal sites,

--indicated that off-base data was needed in order to completely identify the magnitude and extent of the contamination problems,

--concluded that the Phase II study may not have determined the rate and direction of contaminant movement, and

--questioned some of the monitoring and sampling procedures used in the study. (See pp. 8 and 9.)

In addition, the regulatory agencies criticized the final report for its failure to recommend any cleanup measures and questioned the effectiveness of some of the recommendations. (See pp. 8 and 9.)

The Phase II study did not determine the magnitude and extent of the contamination problem, at least in part, because of (1) Air Force officials' belief that the magnitude and extent of McClellan's contamination problem could be determined through other procedures (such as monitoring wells) without analyzing the contents of individual disposal sites and (2) uncertainty over the Air Force's responsibility and authority to finance and conduct off-base work. (See p. 9 through 12.)

The Phase II study also drew criticism because its release to regulatory agencies and the public was delayed by the Air Force's internal review process. An interim report was completed by the contractor in August 1982, but the final report was not released to the public until July 1983. Several different offices within the Air Force were involved in reviewing the report. (See pp. 20 through 22.)

Since completion of the Phase II report, the Department of Defense, the Air Force headquarters organizations, Air Force Logistics Command, and McClellan have taken actions to improve the Installation Restoration Program. These improvements relate to (1) clarifying responsibilities for off-base response actions, (2) reducing delays in the release of data to concerned groups outside

the Air Force, and (3) improving coordination with regulatory agencies. In addition, Air Force officials now acknowledge that some work is needed to determine the amount and type of contaminants in individual disposal sites. The Air Force has contracted for development of a soils investigation program for an area of the base considered to have some of the worst problems. (See pp. 28 and 29.)

MODIFIED DATA RELEASE AND OTHER PROCEDURES WILL PROVIDE FOR MORE INVOLVEMENT BY REGULATORY AGENCIES

State and local regulatory agencies have been trying for several years to determine the magnitude and extent of McClellan's contamination problem, but their efforts have repeatedly been hampered because the Air Force did not respond in a timely manner to requests for data and information. This problem was most pronounced during the Phase II study when McClellan did not release preliminary data and draft reports to regulatory agencies. It was Air Force policy to release only finalized data because of concern over premature dissemination to the public. (See pp. 23 through 29.)

When the regulatory agencies were given an opportunity to comment on the final report in July 1983, they expressed numerous concerns that the Air Force is now having to address. The Air Force headquarters organizations, Air Force Logistics Command, and McClellan officials now recognize the importance of getting regulatory agency participation throughout the Installation Restoration Program and have modified procedures to insure greater involvement by these agencies in the planning and scoping of Installation Restoration Program efforts. Procedures for releasing the Program data have also been changed. Two changes announced in June were to

--institute a multistep Phase II process which allows for the release of information to interested federal, state, and local agencies at the end of each step, and

--routinely provide copies of Installation Restoration Program reports to congressmen in whose jurisdiction the installation is located 10 days prior to public release of the reports. (See pp. 28 and 29.)

VIEWS OF AGENCY AND CONTRACTOR OFFICIALS

GAO did not obtain official agency and contractor comments on this report. However, a draft of the report was discussed with contractor and Department of Defense officials.

The Phase II contractor basically agreed with the data as it is presented in the report, but does not agree with the regulatory agencies' overall assessment of the Phase II report.

DOD officials stated that the report accurately portrayed the situation at McClellan Air Force Base.

Contents

ABBREVIATIONS

AFB	Air Force Base
AFLC	Air Force Logistics Command
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOD	Department of Defense
DOHS	Department of Health Services
EPA	Environmental Protection Agency
HWMB	Hazardous Waste Management Branch
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
OEHL	Occupational and Environmental Health Laboratory
PCB	Polychlorinated Byphenyl
PPB	Parts Per Billion
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
TCE	Trichloroethylene
VOC	Volatile Organic Compound

GLOSSARY

Aquifer	Water bearing geologic formations that are both permeable and porous and so yield water readily to wells.
Downgradient	In the direction of the flow of groundwater.
Grouting	Applying or injecting a fluid mixture of cement and water, or a mixture of cement, sand, and water, into a grout hole so as to form an impermeable barrier.
Hydrogeology	The structure of the earth's crust in a given region including rock, sand, or gravel type formations and the water contained in the region.
Metals	Heavy metals
Permeability	Capacity of a porous rock, soil, or sediment for transmitting a fluid without damage to the structure of the medium.
Plume	Pathway of chemical constituent flow in underground water systems.
Solvent	Chemicals used to dissolve various other substances such as grease and oil on aircraft parts.
Synergistic	A concentration of chemicals working together.
Well casing	Metal pipe used to line the borehole of a well.

CHAPTER 1

INTRODUCTION

About four years ago, McClellan Air Force Base (AFB), Sacramento County, California, found that its water contained concentration levels of the solvent trichloroethylene (TCE) that exceeded the state's criteria for drinking water. Since that time, a number of actions have been undertaken to deal with groundwater contamination problems at the base.[1] Most of these actions have been carried out under the Installation Restoration Program.

DEPARTMENT OF DEFENSE'S INSTALLATION RESTORATION PROGRAM

The Installation Restoration Program (IRP) is a Department of Defense (DOD) program, started in 1975 by the Army, to (1) identify and evaluate suspected problems associated with past hazardous material disposal sites located on DOD installations and (2) control the migration of hazardous environmental contamination from these sites. Initially, this program only applied to contaminated lands and facilities which were or might become excess to DOD's needs. However, in June 1980, DOD expanded the program to include all DOD installations.

The Air Force provided its initial IRP policy guidance in December 1980 and started its program in January 1981. Under this policy, the Air Force's Major Commands are responsible for implementing the IRP.

The Air Force's implementation of the IRP was preceded by the passage of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601 (CERCLA). Under CERCLA, which is commonly known as Superfund, federal entities are responsible for the identification and clean up of any hazardous substances released at waste sites.

Executive Order 12316, dated August 14, 1981, specified federal agencies' responsibilities under the Superfund legislation. In the Order, the Secretary of Defense was given responsibility for the following on DOD facilities and vessels:

--Response actions (i.e., removal of contaminants and remedial actions to solve the problems caused by hazardous waste pollution);

--Investigating, monitoring, surveying, and testing for hazardous wastes; and

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[1]Details on water contamination are discussed in chapter 5.

--Such planning, legal, fiscal, economic, engineering, architectural, and any other studies or investigations as necessary for response actions, cost recovery, and to enforce the provisions of CERCLA.

FOUR PHASES OF THE IRP

The IRP is divided into four phases. Phase I is an installation assessment. In this phase, installation files are examined, current employees and key former employees are interviewed, and the terrain and facilities are examined. Additionally, all available information on past mission, current operations, waste generation, disposal practices, and hydrogeology[2] of the area are collected. Limited soil and water sampling may also be conducted to determine if contaminants are present. Phase I studies at every installation currently listed in the DOD IRP are scheduled for completion by the end of fiscal year 1985. McClellan Air Force Base's Phase I report was issued in July 1981.

Phase II is referred to as the confirmation phase. In this phase, a comprehensive survey is conducted to define the problem fully through environmental sampling and analysis. Data are developed to fill identified information gaps revealed during Phase I, and survey data from all technical areas are interpreted and interrelated. The McClellan Phase II report was issued in July 1983.

Phase III is referred to as technology base development. In this phase, control technology is matched with specific contamination problems at a given site to determine the most economical solution. If control technologies do not exist, they are developed in this phase. McClellan has awarded two Phase III contracts as of October 1983.

Phase IV is the operations phase. This phase includes design, construction, and operation of pollution abatement facilities, and the completion of remedial actions. This phase could include the construction of containment facilities or decontamination processes, and associated long-term monitoring systems. As of October 1983, one Phase IV project has been completed at McClellan and a second was ongoing.

DOD requires that its components advise the Environmental Protection Agency (EPA) regional offices, and state and local governments of their IRP activities. Notification should be made for surveys, projects, and finished reports. When health, welfare, or environmental problems are discovered, these agencies should be notified immediately.

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[2]Refers to the structure of the earth's crust in a given region including rock, sand, or gravel type formations and the water contained in the region.

OBJECTIVES, SCOPE, AND METHODOLOGY

In a letter dated July 19, 1983, Congressman Vic Fazio requested us to (1) review the adequacy of the Phase II report prepared for McClellan AFB and (2) evaluate the Air Force's procedures for releasing IRP data and reports to the public. We did not have the expertise to perform a technical evaluation of the report; therefore, we examined the evaluations of the responsible state and local regulatory agencies--the California Central Valley Regional Water Quality Control Board, the State Water Resources Control Board, the Sanitary Engineering and Hazardous Waste Management branches of the California Department of Health Services, and the County of Sacramento Health Department.

At our request, the EPA's Office of Solid Waste and Emergency Response also made a limited technical review of the Phase II report. Although the Office's comments have been incorporated into our report, the Office cautioned that its evaluation did not represent the official position of EPA. The EPA officials, who made the technical review indicated that considerably more effort would be required to thoroughly analyze and understand all the material that was provided in the Phase II report.

We also examined a contractor's evaluation of the Phase II report. This contractor is currently doing work at McClellan under Phase III and must rely on information developed during Phase II.

We met with representatives from the following Air Force organizations:

--The Bioenvironmental Engineering Office in the Surgeon General's office at Bolling AFB, District of Columbia. This office is responsible for overseeing all Air Force Phase II activities.

--The Environmental Policy and Assessment Branch, Engineering Division, Directorate of Engineering Services, Air Force headquarters at Bolling AFB. This office oversees all Phase I, III, and IV Air Force IRP activities.

--The Air Force Logistics Command (AFLC) headquarters in Dayton, Ohio. As McClellan's Major Command headquarters, AFLC is responsible for implementing the IRP at the base.

--The Air Force's Occupational and Environmental Health Laboratory (OEHL) at Brooks AFB in Texas. OEHL is responsible for the administration of Phase II IRP contracts and for the technical review of Phase II IRP reports.

--The Sacramento Air Logistics Center, McClellan AFB, California. The Center's commander has overall responsibility for base operations, including insuring that the base is properly dealing with environmental contamination.

We also reviewed the files, reports, and other records relating to McClellan at the various Air Force activities responsible for the IRP at McClellan.

Finally, we reviewed McClellan's procedures for (1) insuring that its water is safe to drink and (2) notifying the public when water quality problems create a potential health risk.

We did not obtain official agency or contractor comments on this report. However, a draft of the report was discussed with DOD and Phase II contractor officials.

Our review, which was made in accordance with generally accepted government audit standards, is part of an ongoing cross service review of the IRP. The results of our overall review, along with appropriate conclusions and recommendations, will be reported later.

CHAPTER 2

IMPLEMENTATION OF THE IRP

AT MCCLELLAN AIR FORCE BASE

The Air Force Engineering and Services Center awarded a Phase I contract for McClellan on January 26, 1981, making the base one of the first to be included in the Air Force's IRP. The contractor for the Phase I study relied heavily on an ongoing groundwater investigation that McClellan had initiated in August 1979. The base initiated its investigation when the suspected carcinogen trichloroethylene (TCE) was found in the groundwater at other locations in the Sacramento area. McClellan expanded its investigation in November 1979 when TCE and several other Volatile Organic Compounds (VOCs) were discovered in the base's drinking water. A final report on the McClellan groundwater investigation was issued on April 30, 1981.

The contractor's Phase I report for McClellan, issued in July 1981, identified two major areas of concern. First, additional work was needed to clean up a polychlorinated byphenyl (PCB, a hazardous chemical) site that existed in a small area that had been recently purchased by McClellan. Second, a major groundwater monitoring program was needed to pinpoint the source(s) and the extent of TCE groundwater contamination on base and in the surrounding community (off-base).

The Phase I report also indicated that further investigation should be conducted in cooperation with the Arcade Water District, a local water district adjoining the base, to determine the source of water quality degradation in one of the water district's wells. The base's Camp Kohler laundry, which operated from 1942 to 1973, was a suspected source of the contamination that forced closure of this off-base well.

A contract for the Phase II study at McClellan was awarded on September 28, 1981 to Engineering-Science, Inc. The Phase II study concentrated on the on-base TCE problem. McClellan officials indicated that they did not address the PCB problem in the Phase II study because the PCB had been cleaned up during the summer of 1981. A letter from the Hazardous Waste Management Branch, California Department of Health Services, noted the following about this cleanup effort:

> "We sincerely appreciate the expeditious and cooperative action you have taken to correct a serious environmental problem, not of your making, for the local community. Again we add our congratulations with the Regional Water Quality Control Board in expressing our appreciation for a job well done."

McClellan officials stated that they did not do any off-base work during Phase II because of an Air Force Headquarters decision to defer all off-base work until DOD and EPA reached agreement on the policies and procedures for accomplishing it. Additional reasons cited for not addressing the Arcade Water District issue during the Phase II study included the following:

--Camp Kohler was not the confirmed source of contamination.

--The contamination in the Arcade Water District well consisted of total solids, chlorides, and hardness, which do not pose a serious health threat.

--The Air Force had limited IRP Phase II dollars and chose to spend the available funds on the more serious TCE issue.

Initially, the Phase II study was expected to be finished by July 1982. However, primarily due to the length of time the Air Force took to review the Phase II report, it was not released to regulatory agencies and the public until July 1983.

The Air Force had awarded two Phase III contracts for McClellan as of October 14, 1983. Under the first contract, the contractor is to (1) develop plans for closing 9 of the 46 waste disposal sites identified in Phase I (all 9 sites are in "Area D" in the northwest part of the base); (2) develop a soils investigation program to define the magnitude and extent of environmental contamination in and around the identified waste disposal sites; (3) screen and conduct a cost-benefit analysis of the feasible remedial action alternatives based on cost, engineering feasibility, and environmental impacts; and (4) recommend solutions. Under the second contract, the contractor is to develop specific methods for sealing and monitoring base water supply wells so that contaminated shallow groundwater will not enter the deeper water aquifers used by the base's water production wells.

A listing of additional IRP actions tentatively scheduled for fiscal year 1984 is shown in the following table. Additional work is also scheduled for succeeding fiscal years with all work to be funded by the end of fiscal year 1987. The total cost estimate for fiscal year 1984 through fiscal year 1987 is currently more than $29 million.

McClellan IRP Activities
Tentatively Scheduled For Fiscal Year 1984

Action	Estimated Cost
Off-base monitoring, to include construction of monitoring wells	$ 575,000
On-base monitoring and pumps	100,000
On-base well-sealing	400,000
On-base monitoring	40,000
Interim cleanup of disposal site #4:	
Installation of a temporary cover	101,347[1]
Free liquid removal	30,000
Site characterization work (Areas "B", "D", "C-1", and "C-2")	1,450,000
Cleanup of Area "D"	2,500,000
Inspection and repair of industrial waste lines	285,000
Feasibility study for a contamination interception system/contamination plume control	300,000
Architectural and engineering work for cleanup of Area "A" (which is located on the base's southeastern boundary and contains five sites)	100,000
Architectural and engineering work for cleanup of Area "B" (which is located on the base's southern boundary and contains three disposal sites)	50,000
Architectural and engineering work for cleanup of Area "C-1" (which is located on the base's western boundary and contains ten disposal sites)	150,000
Architectural and engineering work for cleanup of Area "C-2" (which is located on the base's western boundary and contains ten disposal sites)	150,000
Architectural and engineering work for cleanup of other sites	100,000
Total	$5,991,347

[1]Already funded

CHAPTER 3

MCCLELLAN'S PHASE II REPORT DID NOT ACCOMPLISH ITS OBJECTIVES

To accomplish Phase II at McClellan, the confirmation study to define and quantify the existance of contamination, the Air Force contracted with Engineering-Science, Inc. for a study and report that was supposed to (1) determine the magnitude and extent of contamination which has resulted from previous waste disposal practices, (2) make recommendations for actions to mitigate adverse environmental effects of existing contamination problems, (3) suggest potential ways of restoring the environment to as near a normal level as is practical, and (4) suggest a future environmental monitoring program to document environmental conditions.

After analyzing the data that was developed during the study, the contractor concluded that cleanup measures were either prohibitively costly or ineffective. As a result, the final Phase II report did not recommend any cleanup actions and, instead, concentrated on measures to mitigate the adverse environmental effect of the existing contamination problem.

In view of the conclusions consistently arrived at by state and local regulatory agencies and the preliminary assessment of the Environmental Protection Agency's Office of Solid Waste and Emergency Response, we believe (1) the Phase II study did not adequately determine the magnitude and extent of the base's environmental contamination problem and (2) additional information is needed before appropriate corrective actions can be developed. A similar view was expressed by the Phase III contractor doing site closure work in Area "D".[1] Specifically the regulatory agencies and the Phase III contractor

--pointed out that the Phase II study did not determine the amount and type of wastes in the disposal sites,

--indicated that off-base data was needed in order to completely identify the magnitude and extent of the contamination problems,

--concluded that the Phase II study may not have determined the rate and direction of contaminant movement, and

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[1]The term "Phase III contractor," when used in this chapter refers to the contractor doing site closure work in Area "D".

--questioned some of the monitoring and sampling procedures used in the study.

In addition, the regulatory agencies criticized the final report because it did not recommend any cleanup measures and questioned the effectiveness of some of the recommendations made to mitigate the adverse environmental effect of the existing contamination problems. The agencies also questioned the length of time it took the Air Force to review the report before its public release.

The contractor that did the Phase II work for the Air Force does not agree with the regulatory agencies' overall assessment of the Phase II study and report. It acknowledges that some additional work is needed before corrective actions can be implemented. However, it believes the recommendations in its final report represent a logical and cost effective solution to the base's contamination problem. Conversely, it believes that a program to cleanup McClellan's contaminated soil and groundwater could never be fully successful and would constitute a waste of taxpayer dollars.

Since completion of the Phase II report, the DOD, the Air Force headquarters organizations, the AFLC, and McClellan have taken actions to improve the IRP. These improvements relate to (1) clarifying responsibilities for off-base response actions, (2) reducing delays in the release of data to concerned groups outside the Air Force, and (3) improving coordination with federal, state, and local regulatory agencies. In addition, Air Force officials now plan to accomplish further site characterization work and, as noted on page 6, have already contracted for development of a soils investigation program for Area "D".

WASTES IN DISPOSAL SITES NOT PROPERLY CHARACTERIZED

Several regulatory agencies noted that the Phase II study did not determine the characteristics of the waste materials contained in various disposal sites. They concluded that it is, therefore, impossible to develop appropriate remedial actions.

At least two of these regulatory agencies contacted McClellan about the need for site characterization work long before the Phase II report was completed. For example, in August 1982, a letter from the Hazardous Waste Management Branch (HWMB) of the California Department of Health Services requested that McClellan submit by November 1982 a plan for investigating the "vertical and lateral extent of all known and suspected hazardous waste contaminated sites on the base." The letter indicated that, upon receipt of this site characterization plan, HWMB would

review and comment on its adequacy. The letter also stated that alternative cleanup and/or mitigative measures could be evaluated, once the extent of the problem was defined to the satisfaction of HWMB.

Although officials from the California Regional Water Quality Control Board had also indicated that such a plan would be required, McClellan officials did not think it was cost effective to do the site characterization work. When these officials sought guidance from AFLC, they were advised that the Air Force must objectively evaluate the concerns of outside agencies, but retained the prerogative for making the final decision on what was to be done and how it was to be accomplished.

AFLC's guidance was supported, in part, by the base's Staff Judge Advocate's Office. In an October 20, 1982, letter to the base's Chief of Bioenvironmental Engineering Services, the Deputy Staff Judge Advocate stated the following:

> " . . . we have found no authority which would allow the Department of Health Services to require specific action such as 'drill a test well at . . .', although the quality control board may have such authority. Recommend that we answer Health Services 24 August 1982 letter utilizing our Installation Restoration Program."

Since Air Force officials believed that both the IRP Phase II and state cleanup goals could be accomplished without the site characterization work, McClellan made no effort to prepare the plan requested by HWMB or to develop the site characterization data.

However, as recommended by the Deputy Staff Judge Advocate, the base's Chief of Bioenvironmental Engineering Services advised HWMB in an October 29, 1982, letter that the base's Phase I and Phase II reports would provide "...the actions which you are requesting and will provide us the information we require to determine possible corrective actions." The letter also indicated that the Phase II findings "should" be available within the next few months.

When HWMB officials were provided a copy of the Phase II report in July 1963, their review disclosed that the report did not provide most of the information they had requested. Specifically, the report did not include a

--sampling program to quantify the width and depth of each contaminated site,

--sampling safety plan,

--sampling and laboratory analysis quality control program, and

--site-by-site investigation time schedule.

In its comments on the Phase II report, HWMB concluded that the future investigation and cleanup/mitigation of McClellan's hazardous waste problem had been significantly delayed by this lack of cooperation by the Air Force. The letter also repeated the branch's request for a site characterization plan and asked that the plan be submitted by August 31, 1983.

EPA officials in the Office of Solid Waste and Emergency Response also criticized the report in its preliminary comments because it did not properly describe the characteristics of the wastes contained in the disposal sites. EPA officials cited the following evidence to show that insufficient data had been developed to fully characterize the extent of contamination.

--In some cases, locations of disposal sites were unknown.

--In other cases, drums of materials were thought to exist, but either the condition of the drums or their contents were unknown.

--Contradictions existed between what was reported as being disposed at a site and what was found in groundwater at the site.

--Groundwater samples did not give any reliable data on the depth of contamination.

The EPA officials concluded that, "In general, the current report verifies that a problem definitely exists, however, a comprehensive, well designed sampling plan needs to be implemented so that appropriate remedial activities can be planned."

On August 31, 1983, McClellan gave HWMB a draft action plan that contained a proposed time schedule for investigating the various disposal sites on base. Under this proposed time schedule, McClellan would concentrate initially on an area in the northwest portion of the base (Area "D"). Other disposal sites would then be investigated in succeeding stages, with all work to be funded by the end of fiscal year 1987. Area "D" was selected for the initial effort because McClellan and regulatory agencies believe its nine disposal sites represent the most serious environmental problem.

On September 13, 1983, McClellan gave HWMB the contractor's site charaterization work plan for Area "D". This plan was reviewed concurrently by McClellan, AFLC, HWMB, and other regulatory agencies.

When contacted on October 27, 1983, officials at HWMB indicated that they were totally satisfied with the cooperation that they are currently getting from McClellan officials.

OFF-BASE DATA WAS NOT OBTAINED

Another shortcoming of McClellan's Phase II study was that it did not do any work to define the magnitude and extent of the off-base contamination problem. This work was considered necessary because of the possibility that TCE contamination in nearby off-base wells was emanating from McClellan disposal sites near the base's northwest boundary. However, it was not accomplished during Phase II because of an Air Force decision to defer off-base work until DOD and EPA reached agreement on who would accomplish the off-base work and how it would be funded. McClellan was still seeking guidance on how to handle the off-base contamination problem as late as August 2, 1983.

The necessary guidance on off-base work was provided on August 12, 1983, when DOD and EPA completed a Memorandum of Understanding that clarified each agency's responsibilities and commitments for conducting and financing response actions authorized by CERCLA. Under this agreement, when there is off-base contamination and clear evidence that a DOD facility is the sole source of the contamination--a condition that McClellan officials acknowledge exists on the base's western boundary--DOD will conduct and finance the response action or assure that another party does so. At DOD's request, EPA will provide technical assistance to DOD.

ESTIMATES FOR THE RATE AND DIRECTION OF CONTAMINANT MOVEMENT ARE QUESTIONABLE

The Phase III contractor and several regulatory agencies stated that the Air Force had not clearly established (1) the rate and direction of groundwater flow or (2) whether the more contaminated upper aquifer was connected with deeper aquifers. They indicated that this information is needed in order to evaluate the magnitude and risk of groundwater contamination which, in turn, is needed in order to determine the appropriate remedial action(s).

EPA officials and the Phase III contractor both questioned the Phase II report's conclusion concerning the direction of groundwater movement. For example, the EPA officials noted that the location of a ridge between Sacramento and McClellan contradicts the report's conclusion of how groundwater flows in the area.

Preliminary results from the off-base sampling program seem to confirm that the direction of contamination movement is not clearly defined. For example, in a September 20, 1983, report to AFLC, McClellan noted that

> "The contamination migrating from Area "D" appears to be heading in a northerly direction, which does not agree with IRP Phase II ground water flow conclusions."

The Phase II report also may not have correctly determined the rate (velocity) of groundwater movement. The Phase III contractor and the State Water Resources Control Board both indicated that the rate of flow shown in the report was much less than that expected for groundwater in the vicinity. In addition, the Phase III contractor indicated that the Phase II report used an incorrect formula to calculate the groundwater velocity, and concluded that the groundwater velocity is probably a good deal higher than that calculated in the report.

Because of this possible understatement of groundwater velocity, the Phase III contractor concluded that the contamination plume for Area "D" may have moved much farther than the 1,000 feet indicated in the Phase II report. For this reason, it indicated that the Phase III investigation should encompass a much larger off-base area than suggested in the Phase II report.

The State Water Quality Control Board reached a similar conclusion. It agreed with the Phase II report's statement that groundwater contamination could or would migrate off-base. However, it indicated that the contamination may not be limited to 1,000 feet of the base's perimeter.

An engineer from the Regional Water Quality Control Board identified another reason why it is important to correctly determine the groundwater velocity. He noted that accurate velocities are needed if the base and regulatory agencies are to properly evaluate possible corrective action(s). For example, if the soil under McClellan has very low permeability (and therefore low groundwater velocity), as the Phase II report suggests, then the feasibility of treating the contaminated area becomes highly questionable.

An additional concern expressed by regulatory agencies pertained to the vertical movement of contaminated groundwater. Both the State Water Resources Control Board and the Regional Water Quality Control Board questioned the Phase II report's conclusion that the deeper aquifers are ". . .disconnected from the shallow aquifer and separated by at least 20 feet of predominantly fine-grained material." For example, the State Board indicated that no evidence was presented to support this statement and noted that all of the geologic materials are interconnected to some degree.

More significantly, the Regional Board pointed out that the Air Force's own data showed that a lower aquifer contains contaminants at concentrations that exceed the state's drinking water criteria. For example, it stated that 7 of the 15 deep wells installed during the Phase II study contained metals at concentration levels that exceeded the state's drinking water standards. In addition, it noted that the 10.0 parts per billion (ppb) detection level used to test for VOCs in these deep wells was higher than the state's criteria in some instances (which in some cases is as low as .1 ppb). It concluded that the deeper aquifers may be contaminated with VOCs at concentration levels that exceed the state's criteria.

The State Board identified a possible source for the contamination in the lower aquifer, noting that any natural separation that might have been present has probably been lost due to the presence of a great number of wells in the area. The Board indicated that improperly sealed (either active or abandoned) wells and borings can act as vertical conduits for the migration of contaminants to lower zones. It stated that this may be particularly true for heavy organic compounds, such as TCE.

McClellan officials did not believe there was serious contamination of the lower aquifers, but indicated that additional samples will be taken and analyzed using procedures that will detect contamination at the appropriate levels[3].

As of October 6, 1983, the Phase II contractor was still maintaining that its findings are supportable; however, McClellan officials acknowledge that the report may not have accurately identified the rate and direction of contaminant movement. As a result, they stated that additional sampling and testing will be conducted in conjunction with Phase III, with the specifics to be developed in cooperation with state and local regulatory agencies. In addition, they said the off-base sampling is going out approximately 5,000 feet from the base's western perimeter.

As noted previously, the purpose of one of the Phase III contracts is to develop specific methods for sealing base water supply wells so that contaminated shallow groundwater will not enter the deeper water aquifers used by the base's water production wells. (See p. 6.)

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[3]As discussed in chapter 5, test results received in late October 1983, disclosed that four base wells contained metals at concentration levels that exceed state and EPA standards. (See p. 37.)

INADEQUATE MONITORING AND SAMPLING

The Phase III contractor, the State Water Resources Control Board, and the Regional Water Quality Control Board questioned (1) the design and construction of the monitoring wells, (2) the location of some of the wells, and (3) some of the sampling procedures used. As a result, they believe that the conclusions drawn, based on tests from the wells, may not be completely accurate.

For example, the Phase II report described a number of the monitoring wells used in the Phase II study as dry, not containing adequate water for pumping, or containing silty or turbid water. The State and Regional Water Control Boards pointed out that these conditions may be indicative of poor well design and/or construction by the Phase II contractor or the Air Force. The boards concluded that the water quality and hydrogeological characteristics obtained from these wells may be erroneous.

The Phase III contractor questioned the location of the Phase II monitoring wells. For example, it noted that, in general, there is a lack of monitoring wells in areas downgradient (direction of water flow) from the pollution sources where a plume (the pathway of chemical constituent flow in underground water systems) of contamination would be expected to be present. It indicated this was particularly true for the deeper monitoring wells.

The State and Regional Water Control Boards also pointed out several examples where monitoring wells did not appear to be correctly sited. One of these examples was monitoring Well 36S, which was installed immediately northwest of six disposal pits and which Phase II testing showed to be virtually clean. The conclusion reached from the Phase II test results was that constituents did not appear to be leaving the base from this area. The Regional Board pointed out, however, that the groundwater flow in this area appeared to be in a southwesterly to westerly direction and concluded that monitoring Well 36S could be outside the contamination plume eminating from these pits.

In its response to the Regional Board's comments, the Phase II contractor acknowledged that Well 36S may be outside the contamination plume of the six burial pits; however, it also noted that " . . . when decisions must be made regarding the apparent optimum location for one monitoring well, covering an area containing ten individual disposal sites, attempts are made to select a site that could be representative of the entire area."

The Phase III contractor, the State Water Resources Control Board, and the Regional Water Quality Control Board all commented that inadequate sampling procedures were sometimes used to test

the groundwater. For example, the Phase III contractor noted that, "Adequate volumes of water to provide a representative sample were apparently not removed from the well in many cases prior to sample collection." The State Board agreed with this assessment, noting that there is a great risk that these samples may not be representative of the water-bearing zones sampled.

McClellan officials did not disagree that there were problems with the Phase II contractor's monitoring and sampling procedures, but they did point out that the Regional Water Quality Control Board reviewed the contractor's well design and proposed sitings during meetings held in March 1982 and July 1982. Board engineers acknowledge that they participated in these meetings, but indicated that their ability to provide meaningful input was limited by the Air Force's unwillingness to share preliminary data with them.

At the time we completed our review work, McClellan officials told us they were working closely with federal, state, and local regulatory agencies in order to determine what course of action to take.

REGULATORY AGENCIES AND THE PHASE II CONTRACTOR DISAGREE OVER WHAT CORRECTIVE ACTION SHOULD BE TAKEN

After analyzing the data that had been developed on the magnitude and extent of McClellan's contamination problem, the Phase II contractor concluded that:

--Because of the large number of disposal sites (46 have been identified and others are suspected to exist) and the proximity of many of these sites to one another, the identification of a plume of contamination for individual disposal sites is virtually impossible.

--Soil in many of the disposal sites is probably contaminated down to a depth of 100 feet or more.

--Since waste disposal has been ongoing at McClellan for nearly 40 years, the plume of contamination emanating from the base's 46 or more disposal sites has probably spread to cover a major portion of the base.

--Excavation of waste materials would be prohibitively costly because of the extensive volumes that are involved.

--Treatment of the contaminated soil and groundwater is not feasible, primarily because of the low permeability of McClellan's soil.

--Contamination is generally limited to the upper aquifer.

--The contaminated upper aquifer is not connected with the lower aquifers, except by wells with gravel packed casings.

The Phase II contractor further concluded that (1) the upper acquifer under McClellan cannot be salvaged and (2) any future actions should concentrate on the prevention of further contaminant migration--either downward into lower aquifers or further off-base. As discussed in the preceding sections of this chapter, regulatory agencies questioned these conclusions as well as many of the contractors specific findings. As discussed below, they also criticized the report because it did not make appropriate recommendations.

Suggestions to Restore the Environment

The Phase II report identified several alternatives for restoring the environment to as near a normal level as practical; however, as noted previously, it concluded that the extensive volumes of soil which would require disposal or treatment, combined with the low permeability of McClellan's soil, made these alternatives either ineffective or prohibitively costly. Consequently, the report did not recommend any cleanup measures. Instead, the report recommended that sites found to impact groundwater quality be capped with an impermeable barrier to prevent precipitation moisture from contacting affected materials.

In its preliminary comments, EPA indicated that, "The recommendation to cap the waste sites ignores the problems that exist. The ground water is already contaminated and capping the sites will not preclude organic solvents from penetrating further into the soil." EPA went on to state "The brief discussion concerning closure of the waste sites is totally inadequate and reflects the lack of knowledge concerning the requirements of the Resource Conservation and Recovery Act (RCRA). RCRA has specific closure requirements which include liners and long-term monitoring; therefore, such waste sites cannot simply be capped or buried."

The Hazardous Waste Management Branch's comments on the Phase II report clearly indicated that the recommendation to simply cap the disposal sites was unacceptable. These comments indicated that, "All confirmed hazardous waste sites at McClellan AFB must be either eliminated or be totally contained by reliable, long-term controls."

In their informal comments on our draft report, McClellan officials said they believe there are economical solutions to the base's contamination problem besides the capping alternative included in the Phase II report. They indicated that these alternative solutions would be developed during Phase III/IV of the IRP. They also indicated that this effort is already underway and is being accomplished in close coordination with federal, state, and local agencies.

The Phase II contractor, on the other hand, still manintains that there is no cost effective way to cleanup McClellan's contaminated soil and still believes the only rational approach is to mitigate the adverse environmental effect. For example, the contractor's technical advisor for the Phase II study said the Air Force could easily spend hundreds of millions of dollars to cleanup McClellan's contaminated soil and groundwater, and still not solve the problem.

Recommendations to Mitigate Adverse Environmental Effects

The Phase II contractor concluded that two basic things were needed in order to mitigate the adverse environmental effect of the existing contamination problem. First, something had to be done to insure that wells in the area did not provide a conduit for the migration of contamination from the upper acquifer into the lower acquifers. Secondly, the lateral migration of contamination in the upper acquifer had to be stopped by the installation of some type of device. To satisfy these two requirements, the Phase II report provided the following recommendations:

--On-base and off-base wells that have gravel packed casings should be sealed by slant drilling at depths from 75 to 120 feet.

--Base monitoring wells 1, 2, 3, and 4 should be abandoned by pressure-grouting directly into the well casings. (The report indicated that the grout would flow through the perforations in the well casing and move into the gravel packs.)

--Determine the feasibility of using an interception drain system to prevent the future migration of affected shallow groundwater off-base.

--New wells being installed downgradient from the base boundaries should be grouted to a minimum depth of 120 feet.

The State Water Resources Control Board questioned the effectiveness of using slant-drilling to seal on-base and off-base wells, and suggested another approach. In addition, in subsequent contacts with the Regional Board, we were told that the effectiveness of the second recommendation has yet to be demonstrated. As noted previously (see page 6), a Phase III contractor has already been tasked to develop specific methods for sealing base wells.

The County of Sacramento, in its comments on the report, surfaced the following additional concerns about the proposed program to seal existing off-base wells.

--The specific geographic area needs to be more clearly defined.

--Sacramento County would agree to locate and identify wells once the area is defined, however, the administration and funding of this program must be resolved.

--Existing water wells, other than gravel pack types need to be considered if a program of sealing off the upper aquifer is to be successful.

The County also made the following comments about the proposal to require new off-base wells to be grouted to a minimum depth of 120 feet.

--Monitoring of soil and shallow and deep aquifers is needed off-site before the department can support this recommendation.

--The geographical area of concern needs to be defined after more information is developed.

--Does the Air Force plan to compensate individuals for additional drilling costs?

Finally, two additional factors surfaced during our discussions with the Phase II contractor. First, the contractor

indicated that the approach it is recommending will only work if the upper aquifer is not connected with the lower aquifers--a condition that, as noted previously, several of the regulatory agencies have questioned. Secondly, the contractor stated that the interception drain system, to be effective, should be installed downgradient from any contaminated groundwater (which would probably place it well beyond the base's current boundaries). Because of these two factors, the contractor indicated that (1) additional testing is probably appropriate to determine whether the upper aquifer is connected with the lower aquifers and (2) sufficient sampling and testing must be accomplished off-base to determine exactly how far the contamination has spread.

Suggestions for Future Environmental Monitoring

The Phase II report indicated that monitoring should be implemented on-base and off-base, and should continue indefinitely until such time as deemed no longer necessary. The report also said that, "Constituents to be analyzed should include a tracer from the following groups: volatile compounds (TCE), acid compounds (pentachlorophenol), and base/neutral compounds (1,2-dichlorobenzene).

McClellan has subsequently implemented part of this recommendation. As noted in chapter 5, the base has been periodically testing its drinking water for VOCs since late 1979 and has recently initiated an off-base testing program. However, as of November 15, 1983, neither the on-base nor the off-base monitoring program includes testing for acid compounds and base/neutral compounds.

PHASE II REPORT DELAYED BY REPORT REVIEW AND APPROVAL PROCESS

The release of the final Phase II report to the regulatory agencies and the public was delayed by the Air Force's lengthy internal review process. This review process began when Engineering-Science, Inc., the Phase II contractor, completed an interim report in August 1982. It continued until the final report was released to the public in July 1983. During the intervening 11 months, two drafts of the final report were reviewed by (1) the Occupational and Environmental Health Laboratory (OEHL, the Air Force's technical representative for Phase II studies and reports), (2) AFLC (McClellan's Major Command headquarters), and (3) the engineering and bioenvironmental offices at McClellan.

The first draft of this final report was reviewed by AFLC, OEHL, McClellan and contractor representatives during a meeting held on December 5-9, 1982. Although no formal comments were ever made on the report, the OEHL representatives did complete a trip report that outlined what was discussed. In addition, the changes the contractor was supposed to make were documented by the contractor's stenographer on a mark-up copy of the report draft.

According to the OEHL representative's trip report, all of the Air Force representatives wanted the Phase II report strengthened, especially the chapters dealing with alternatives and recommendations (5 and 6). Most of the proposed changes were for adding more material to the alternatives already included in the report.

Two things were decided at the meeting. First, the report would recommend (1) grout sealing of on- and off-base wells, (2) further well monitoring, and (3) capping of some of the disposal sites. Second, no recommendation would be made to capture or treat the contaminated water in the upper aquifer. The OEHL representative concluded in the trip report that, based on the results of the meeting, McClellan officials probably would not be satisfied with the proposed recommedations because they did not address all of the concerns of the regulatory agencies.

Two months later, in February 1983, the contractor furnished the Air Force with a second draft of the first four chapters. Chapters 5 and 6 were provided in early March 1983.

Contractor and Air Force officials told us that the completion of the second draft was delayed when the contractor lost a significant number of its technical people and some of its support staff.

McClellan furnished AFLC its comments on the first four chapters on February 24, 1983. These comments were mostly editorial. However, in its April 19, 1983 letter to AFLC on chapters 5 and 6, the base stated that the direction and scope of their actions and requirements for off-base programs had to be established prior to public release of the Phase II report. As noted on pages 28 and 29, this decision was not made until after the Phase II report was issued.

The AFLC, after incorporating most of McClellan's comments, provided its comments on the second draft to OEHL on May 20, 1983. Most of these comments were editorial or expansions upon points discussed in the report.

The OEHL, in turn, provided the contractor with the Air Force's consolidated comments on June 7, 1983. The contractor incorporated these comments into the draft by June 27, 1983.

The reason cited by AFLC officials for the extended length of time it took to review and provide comments on the second draft was that the people who had reviewed the first draft had been transferred before the second draft was completed. Thus, some learning curve time was required for the new reviewers. They estimated that this may have delayed the report by a month or so.

The changes between the first draft and the final report were, to a significant extent, editorial type changes. The discussion in certain sections was expanded and the following three alternatives were added to the final report: (1) off-base landfill of the contaminated soil, (2) on-base landfill, and (3) capping of the disposal sites. Except for the recommendation to cap the disposal sites, the recommendations in the final report are basically the same as those in the first draft.

CHAPTER 4

FUTURE IRP ACTIVITIES WILL INCLUDE MORE INVOLVEMENT BY REGULATORY AGENCIES

State and local regulatory agencies have been trying for several years to determine the magnitude and extent of McClellan's contamination problem, but their efforts have repeatedly been hampered because the base has not responded in a timely manner to requests for data and information. This problem was most pronounced during the Phase II study when Air Force policy prevented McClellan from releasing preliminary data and draft reports to regulatory agencies. As discussed in chapter 3, when these agencies were given an opportunity to comment on the final report in July 1983, they expressed numerous concerns that the Air Force is now addressing. The Air Force, AFLC, and McClellan now recognize the importance of getting regulatory agency participation throughout the IRP process and all have subsequently taken action to insure greater involvement by these regulatory agencies in the future.

COORDINATION PROBLEMS WITH REGULATORY AGENCIES

The Regional Water Quality Control Board (RWQCB) is one of the regulatory agencies that has encountered problems in its dealings with McClellan. As the following chronology of events illustrates, McClellan has not provided requested information and data in a timely manner.

Chronology Of Events
Regional Water Quality Control Board's
Efforts To Obtain Information On McClellan's Disposal Sites

Date	Action
December 7, 1979	RWQCB letter asks for a plan to define the extent of the base's contamination problem. The letter notes that particular attention should be given to proposals for soil and water sampling and geologic investigation.
December 14, 1979	McClellan responds to RWQCB's request for a plan by indicating that it would proceed in three phases--data gathering; evaluation; and action, if necessary. It also indicates that the first two phases should be completed within nine months (September 1980). No specifics are provided.

Date	Action
January 18, 1980	In response to a RWQCB request for specific information on what is to be done, McClellan staff outlines their planned approach; however, detailed plans and specifications are not provided. When RWQCB asks for specific details on where and how the base planned to construct the monitoring wells and accomplish the soil borings, McClellan staff agrees to provide the specific details. However, the McClellan staff indicates this will be for informational purposes, not approval. McClellan will consider any comments.
February 28, 1980	McClellan letter to RWQCB transmits plans and specifications for proposed monitoring wells and soil borings.
March 11, 1980	McClellan awards soil boring contract.
March 31, 1980	RWQCB letter to McClellan provides recommendations on soil sampling and questions design and construction techniques proposed for monitoring wells. RWQCB suggests closer coordination between McClellan engineers and board staff.
April 14, 1980	McClellan letter to RWQCB indicates that it is regrettable that the board was questioning the techniques to be used in the design, construction, and drilling of additional monitoring wells at about the time the contractor is ready to start work and after the Air Force is locked into a contract that, based on all indications, would accomplish the intended purposes.
April 28, 1980	McClellan and RWQCB reach agreement on monitoring well design concepts.
June 12, 1980	Four monitoring wells are completed.
August 13, 1980	RWQCB letter requests McClellan to (1) develop a monitoring program and (2) prepare a report on disposal site pollution potential.

Date	Action
August 25, 1980	McClellan responds to RWQCB letter indicating that (1) it believes its on-base monitoring program is adequate, (2) off-base monitoring is beyond its capability and purview, and (3) it will prepare a report evaluating disposal site pollution potential, with draft of report to be provided by September 30, 1980.
September 30, 1980	McClellan (1) does not provide report on disposal site pollution potential and (2) sets up meeting for October 7 to discuss findings with RWQCB.
October 6, 1980	McClellan cancels October 7 meeting.
October 9, 1980	McClellan letter to RWQCB notifies them that evaluating disposal site pollution potential will be further delayed for internal review by base management. Internal review of draft report expected to be completed by October 24, 1980.
October 31, 1980	McClellan informs RWQCB that groundwater investigation report may not be available until late December.
January 14, 1981	RWQCB sends a letter to McClellan indicating that board would consider issuing McClellan a Cleanup and Abatement Order during a public hearing to be held on January 23, 1981. If adopted, the order would require McClellan to submit by no later than February 27, 1981, a plan to define the extent of groundwater contamination.
January 23, 1981	McClellan presents a plan for investigating groundwater contamination to RWQCB at a public hearing. As a result, proposed Cleanup and Abatement Order is not issued.
April 30, 1981	McClellan mails final groundwater report to RWQCB.
July 14, 1981	RWQCB indicates McClellan's groundwater report is an excellent compilation of data, but it also expresses concern about the lack of discussion or interpretation of the data. In addition, RWQCB indicates that the base needs to develop a work plan that answers the following questions about each disposal site: What are the constituents in

Date	Action
	the disposal area? Is there anything, such as a liner, that will prevent contaminants from seeping into the groundwater? What are the appropriate mitigation measures?
July 8, 1982	McClellan staff and the Phase II contractor brief RWQCB staff on the status of the IRP Phase II report. McClellan expresses reluctance to share preliminary data and indicates they want to prepare a final report before making the information available to the press and public. McClellan staff indicates that the final report is due in October 1982 and will contain recommendations for mitigation. RWQCB staff indicates that it is mandatory for McClellan to sample known or suspected sources of contamination in order to quantify the magnitude of the contamination.
August 24, 1982	Hazardous Waste Management Branch (HWMB), California Department of Health Services requests that McClellan submit a plan for investigating the vertical and lateral extent of all known and suspected hazardous waste contaminated sites on the base.
July 22, 1983	Final Phase II report provided to RWQCB. Report does not contain information requested by RWQCB and HWMB.

McClellan officials acknowledge that there have been delays in providing data and information to regulatory agencies, but maintain that they have not deliberately refused to cooperate with these agencies. For example, they gave the following explanation of why the base was unable to prepare a report for the RWQCB during 1980.

> "During the 1980 time period . . ., base personnel were working two major issues. These were the PCB incineration test burn and the groundwater problem. The effort expended to keep abreast of the daily events of both these issues pre-empted the base's ability to prepare the detailed report requested by the RWQCB."

Base officials also noted that Air Force IRP policy prevented McClellan from fully cooperating with state and local agencies during Phase II. For example, when AFLC forwarded a copy of the interim Phase II report to McClellan in September

1982, the transmittal letter cautioned the base that the report was an internal working document that was not intended for distribution outside the Air Force. According to an AFLC official, this guidance was based on Air Force policy which precludes the piecemeal release of report information to outside agencies. Because of this policy, regulatory agencies were not allowed to review the interim and draft Phase II reports and were not provided preliminary data.

This policy of not releasing preliminary Phase II data, combined with repeated extentions in the expected delivery date of the final report, nearly led to a confrontation between McClellan and the Regional Water Quality Control Board. In a May 12, 1983, letter to the McClellan base commander, the Executive Officer of the Board noted the following about the problem.

> "My staff has informed me that water quality data developed during Phase II of the ongoing groundwater pollution study will not be released by the Air Force until the various remedial alternatives and recommendations are fully analyzed and the final report completed. At a status meeting held at the Base on 5 August 1982, it was estimated that the final report would be distributed by 1 November 1982. Subsequent correspondence indicated that the Phase II data would be available in January 1983 and then in April 1983 . . . the final report is now scheduled for distribution in July 1983."

In his letter, the Executive Officer said he appreciated the Air Force's desire to carefully review the water quality data and develop remedial measures; however, he also pointed out that the Board needed the data as expeditiously as possible in order to (1) determine (together with the state and county health departments) potential impacts to on- and off-site groundwater users and (2) effectively monitor off-site groundwater quality. The letter concluded by indicating that all water quality and soils data generated during the Phase II study "must be" submitted to the Board by May 23, 1983.

Base officials advised AFLC of the Board's request; but AFLC officials repeated their concern about prematurely releasing anything to outside agencies prior to the completion of the final report.

On May 26, 1983, a message from the Sacramento Air Logistics Center's Commanding General informed OEHL, AFLC, and Air Force headquarters that base officials had met with the Regional Board in order to avoid a possible confrontation over the release of the Phase II data. The General said the Board

(1) remained firm in its demand for the immediate release of data, (2) was not pleased with the repeated delays in the completion of the Phase II study, (3) was under the impression that the base might be engaging in a coverup and "stonewalling", and (4) planned to pursue the release of data through all available means, including court action.

In his message, the General proposed that the Air Force release the data, noting that, "Any problems associated with releasing data at this time are far outweighed by the need for continued close relations and cooperation with the state and local community, a need that goes far beyond the IRP."

On May 27, 1983, OEHL released all Phase II raw data to the Board.

ACTIONS TO IMPROVE COORDINATION WITH REGULARORY AGENCIES

On June 6, 1983, the Air Force revised its IRP guidance in order to insure better coordination of Phase II activities with non-Air Force agencies. This action was taken because the Air Force had undertaken some Phase II surveys which, because of their scope and complexity, were taking in excess of 1 year to complete. The resulting delays in completing and distributing the final report to non-Air Force agencies was giving the impression that the Air Force was reluctant to release the information because it might be incriminating.

The revision of the IRP guidance was made possible by the implementation of a multistep, incremental approach to Phase II that includes a series of discrete decision points. Each of these decision points requires both a summation and interim analysis of data and each, therefore, provides an opportunity to make simultaneous information transfers to interested federal, state, and local agencies. Under the new IRP guidance, major commands are to insure that regulatory agencies are provided

--information either verbally or in writing at the end of each step in Phase II, and

--a verbal update whenever there is a significant delay in the Phase II schedule.

As in previous guidance, regulatory agencies are also to be provided an information copy of the final Phase II report.

On September 7, 1983, AFLC issued further IRP guidance to its subordinates that emphasized the importance of coordinating all IRP activities with regulatory agencies. This guidance stated, in part, the following:

"Due to recent events concerning hazardous waste disposal and more specifically the Air Force IRP, the importance of keeping all regulatory groups fully informed about IRP activities cannot be over emphasized. We must include all Federal, State, and Local regulatory organizations in our review of all phases of IRP. Regulatory agencies should be requested to provide comments on reports on all phases of the IRP and also on all statements of work prior to submission to contractors for bids. This should insure all questions are resolved during field work. This should also preclude re-opening the field investigation at a later date."

McClellan had already implemented this approach prior to receiving AFLC guidance. A task force consisting of representatives from the base and from state and local regulatory agencies was formed on August 5, 1983 to (1) oversee the cleanup of ground water that has been contaminated from past waste disposal practices and (2) assure proper and timely government actions are taken to resolve the problem quickly. The task force has been dealing with both on-base and off-base contamination.

CHAPTER 5

CONTAMINATION OF DRINKING WATER

IN THE MCCLELLAN AIR FORCE BASE AREA

In late 1979, McClellan AFB officials discovered that the base's drinking water was contaminated with Volatile Organic Compounds (VOCs). One of these VOCs, the suspected carcinogen trichloroethylene (TCE), was present at concentration levels that, according to the California Department of Health Services (DOHS), pose an unacceptable health risk to those drinking the water for extended periods of time. Although this condition persisted until August 1980 (and to a much lesser extent until July 1981), base officials did not advise DOHS or individuals drinking the water of this potential health risk because they (1) did not think the contamination levels were high enough to represent a significant health risk, (2) did not want to create a panic situation and, (3) considered the state's criteria for TCE to be an unofficial guideline since it was an "action level" and not a formal standard.[1]

McClellan has reduced contamination levels substantially since November 1979 by taking four contaminated wells out of its water distribution system and test results indicate that the base's water has generally met the state's drinking water criteria since July 1981. However, expanded and improved testing procedures may be needed in order to demonstrate this fact conclusively.

McClellan is now working with state and local regulatory agencies to determine the extent of contamination of water wells in the areas adjoining the base. They are making tests of the water, financing the installation of monitoring wells, and providing alternative water supplies for some of the off-base population.

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[1]DOHS has established either a Maximum Contaminant Level (MCL) or an "action level" for many of the chemicals that have been found in McClellan's drinking water. Both MCLs and action levels are the maximum concentration level of a contaminant that is considered acceptable by the state. The difference between the two is that MCLs are formal standards promulgated in Title 22 of the California Administrative Code ("California Domestic Water Quality and Monitoring Regulations") while action levels, for the most part, are based on one in a million cancer risk levels. For example, the state's action level for TCE is based on the National Academy of Science's estimate that using drinking water with a TCE concentration of 4.5 ppb will result in one excess cancer per one million exposed population.

MCCLELLAN AFB'S WATER CONTAMINATION PROBLEM HAS EXISTED FOR SEVERAL YEARS

The contamination in McClellan's drinking water was first identified in late 1979, but may have existed for a long time before then. Prior to October 1979, McClellan AFB officials did not test their water for the presence of VOCs because there was no requirement to do so. However, in October 1979 the discovery of TCE in the groundwater at other locations in the Sacramento area prompted McClellan officials to test their water for the contaminant. Tests of samples taken from four wells revealed that one well contained TCE at concentration levels of up to 4.5 parts per billion (ppb) and a second contained TCE at concentrations of up to 1.2 ppb.

These test results were provided to state and local regulatory agencies and information on McClellan's TCE contamination problems was reported in local newspapers.

The thrust of the local newspaper articles was that TCE contamination was not considered a serious problem by state and local regulatory agencies because the concentrations found were equal to or less than the state's 4.5 ppb criteria. For example

--One article quoted a senior engineer from the Central Valley Regional Water Quality Control Board who stated that EPA's guildines for TCE were 4.5 ppb and indicated that he was not concerned about the contamination levels found at McClellan.

--Another article quoted an official from the DOHS who indicated that the state (1) was adopting EPA's recommendation that a 4.5 ppb concentration level of TCE has negligible effect on humans and (2) was, therefore, not advising McClellan authorities to stop using the water.

--The manager of the Division of Water and Sewers for the City of Sacramento said he did not consider the situation critical or urgent because the State Health Department used the 4.5 ppb level as its criteria for TCE.

However, while not overly concerned, the Regional Water Quality Control Board and base officials considered it prudent to take additional samples in order to better define the magnitude and extent of the contamination problem. As a result, in November 1979 an expanded sampling program was implemented both on- and off-base.

The off-base program consisted of testing water from nearby private and city wells for the presence of TCE. As a result of this testing, one city well and two private wells were closed because of TCE contamination.

At the recommendation of the Regional Water Quality Control Board, McClellan's expanded on-base sampling program included not only taking more samples but also testing for additional VOCs. Samples were taken from all water producing wells in operation at the time, from tap locations in seven buildings, and from several water towers. In addition, the samples were tested for 29 VOCs, not just TCE.

This expanded sampling program revealed a much more serious contamination problem. For example, three base wells, three water towers and tap water in two buildings were found to contain TCE at concentration levels above the state's 4.5 ppb action level. In addition, ten more VOCs were identified in the water.

Four of the VOCs that McClellan identified in its drinking water--carbon tetrachloride, chloroform, TCE and 1,1 dichloroethylene--were identified as suspected carcinogens in an October 1979 letter from EPA to the Regional Water Quality Control Board. While TCE has continued to receive most of the media attention since McClellan's groundwater problem was first identified, exposure to these other suspected carcinogens also poses a potential health risk. In fact, the National Academy of Sciences has concluded that drinking water containing any concentration of suspected carcinogens such as TCE may increase the cancer risk in the exposed population.

McClellan officials did not notify base personnel of potential health risks

In November 1979, when McClellan officials received test results which showed a much more serious contamination problem, they contacted AFLC for advice on what action to take. An AFLC official, fearing that the release of the information would create a panic situation, recommended that the test results not be released.

The base Environmental Engineer did not agree with keeping a tight lid on the lab test results. He thought that base employees and the state should be informed of the test results and the corrective action being taken. He also believed that this data should be provided to the press, but only if they specifically requested it.

However, base officials did not believe the concentration levels were large enough to represent a significant health risk and, therefore, did not make a public announcement to indicate

that the problem was worse than first believed. Furthermore, they did not release most of the test results to DOHS. DOHS was told that one base well had a TCE contamination level of 30 ppb, but it was also told that this well had been closed.

In our opinion, the base's lack of full disclosure of the magnitude of its contamination problem had at least three undesirable effects. First, many individuals may have chosen not to drink the water if they had been advised of the magnitude of the problem. Second, according to DOHS officials, they were not aware that other VOCs were present in McClellan's drinking water, and made no effort to establish acceptable concentration levels for them. Finally, no effort was made to test off-base wells for these other VOCs. As discussed later in this chapter (see p. 39), current off-base testing of private wells has disclosed the presence of some of the VOCs that McClellan identified in its water supply nearly 4 years earlier.

Although McClellan officials did not release test results to the public in November 1979, they did take two positive actions to deal with the base's water contamination problem. First, to reduce the contamination levels in their water distribution system, they closed one of the base's contaminated wells. Secondly, to insure that the water was safe to drink, they established a continuous monitoring program that called for (1) the periodic sampling of tap water at seven buildings and (2) the testing of these samples for the presence of 29 VOCs.

During calendar year 1980, laboratory results of water samples taken from the seven buildings continued to show the presence of several VOCs. For example, 5 VOCs--carbon tetrachloride; 1,2 dichloroethane; 1,1 dichloroethylene; TCE; and tetrachloroethylene--were found in concentrations above the state's current action levels.

The state's 4.5 ppb action level for TCE[2] was exceeded far more frequently than that of any other VOC for example, the average readings at buildings 368 and 1074 (two of the seven buildings tested) during the period January 1, 1980, until August 31, 1980, were 7.7 ppb and 7.3 ppb. The readings fell substantially after August 1980.

In general, the readings were highest during the two month period preceeding the closure of well number 12 on August 28, 1980. During this period, TCE readings at the seven buildings exceeded the state's 4.5 ppb action level approximately 63 percent of the time, sometimes by substantial amounts. Buildings 368 and 1074 generally contained the highest concentration levels of TCE.

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[2]The state's 4.5 ppb action level for TCE was recently rounded to 5.0 ppb.

Examples of TCE contamnation
levels at McClellan during 1980

Date	Buildings 368	Buildings 1074	Date	Buildings 368	Buildings 1074
	(readings in ppb)				
July 3	7.0	6.7	August 7	9.0	.5
July 10	6.2	14.0	August 8	6.3	.3
July 14	7.2	13.0	August 11	13.0	2.2
July 25	6.6	18.0	August 12	15.0	17.0
July 30	8.1	23.0	August 13	12.0	21.0
August 1	14.0	24.0	August 14	11.0	1.0
August 4	23.0	30.0	August 15	9.4	9.8
August 5	24.0	.5	August 21	12.0	27.0
August 6	9.2	.5	August 25	44.0	31.0

On August 25, the last day of testing prior to the closure of well number 12,[3] four of the seven buildings tested had TCE readings of 28.0 ppb or higher.

McClellan officials did not advise either base employees or base housing occupants of the potential health risk associated with drinking this water.

This decision was based, at least in part, on guidance from the AFLC official who had recommended that McClellan not release the laboratory results to the public.

Although, the base environmental engineer thought the results should be made public, the Chief of Environmental Health and the Chief of Bioenvironmental Engineering Services at McClellan AFB agreed with the AFLC official's recommendation not to release the test results to the public. They indicated that the decision was based on an objective assessment of the relative advantages and disadvantages of making a public announcement. In their opinion, the test results, while they did exceed the state's criteria, were not high enough to constitute a significant health risk.

If the state's 4.5 ppb criteria for TCE was a formal standard and not an "action level," both Air Force and California regulations would have required McClellan to notify the public that the standards had been exceeded. For example, when an Air Force standard is exceeded, Air Force Regulation 161-44 (Management of the Drinking Water Surveillance Program) requires

[3]Contamination level fell substantially after well 12 was closed for example, average readings at buildings 368 and 1074 during the period September 1, 1980, to December 31, 1980, were 1.6 ppb and 2.0 ppb.

installations to prepare public notifications. These public notifications are supposed to include material facts such as (1) the nature of the problem, (2) preventive measures that base personnel should take, (3) a balanced explanation of the significance or seriousness of the threat to public health, (4) an explanation of steps taken to correct the problem, and (5) the results of any additional sampling. The regulation also requires installations to publicly repeat notices every 3 months as long as the variance exists.

According to Air Force Regulation 161-44, McClellan would also be required to make a public announcement if one of California's drinking water standards were exceeded. However, McClellan officials, while they acknowledge that the base is required to meet California's drinking water standards, said this requirement applies only to the Maximum Contaminant Level standards promulgated in the California Domestic Water Quality and Monitoring Regulations. In their opinion, since the action levels the state has established for TCE and the other VOCs are not promulgated in the Regulations they are simply guidelines that are not legally enforceable.

When questioned about the state's action level for TCE and other chemicals, a DOHS official provided the following information:

--Any contamination at or above an action level poses an unacceptable health risk to those drinking the water.

--Anytime an action level is exceeded, DOHS expects the water supplier to take action to reduce the contamination level.

--The issue of whether or not an action level is legally enforceable has never arisen because, in the past, water suppliers have always acknowledged DOHS's authority to establish action levels and have cooperated voluntarily with the Department.

--No formal requirement has been established for water suppliers to (1) periodically test for VOCs or (2) notify DOHS whenever an action level is exceeded; however, DOHS is in the process of establishing such a requirement.

--While DOHS does not require a public announcement every time an action level is exceeded, it would have recommended such an announcement had it known about the TCE contamination levels that existed at McClellan during the first 9 months of 1980.

In their informal comments on our draft report, McClellan officials said they have been and will remain committed to meeting the state's 4.5 ppb action level for TCE, even though the Air Force's criteria is 270 ppb[4]. In addition, the Chief of Bioenvironmental Engineering Services subsequently told us that, in the future, the base will notify DOHS whenever a state action level is exceeded and will make a public announcement if requested to do so by the state.

CURRENT TEST RESULTS

While current test results indicate that McClellan's water now meets the state's drinking water criteria, we found that

--the base's water tests did not cover all contaminants identified in the Phase II study, because current regulatory requirements did not require testing for most of the contaminants,

--the testing levels used to detect one of the contaminants were not as stringent as the testing levels prescribed by state criteria, and

--neither standards nor action levels have been established by either the state or EPA for some of the contaminants that have been identified in the base's water.

As noted previously, the contamination levels in McClellan's water were reduced substantially by removing four contaminated wells from the water distribution system. One of these wells was removed in November 1979, a second in March 1980, a third in August 1980, and the fourth in July 1981. Test results since July 1981 have generally indicated that the water meets the state's criteria. Contamination levels for TCE, for example, have generally been less than 0.5 ppb since July 1981.

However, McClellan is not testing its drinking water for some of the contaminants that may be present. For example, the final phase II report recommended that the base periodically test its drinking water with a tracer from the following groups: VOCs (TCE), acid compounds (pentachlorophenol), and base/neutral compounds (1,2 dichlorobenzene); however, as of November 8, 1983, the base had not yet implemented this recommendation for acid compounds and base/neutral compounds. Similarly, seven of the fifteen deep monitoring wells constructed during Phase II contained metals at concentration levels that were as much as 23 times greater than state and EPA standards; yet, when we started

[4]This is the Air Force's criteria. It equates to a cancer risk level of 60 per one million exposed population.

our review in August 1983, McClellan had not tested its drinking water for these metals since January 1982.

When questioned about the base's lack of testing for some of the contaminants identified during the Phase II study, McClellan's Chief of Bioenvironmental Engineering Services pointed out that the Phase II monitoring well samples were taken from relatively shallow water acquifers which are likely to be far more contaminated than the deeper acquifers used by the base production wells. He also emphasized that (1) the base is only required to test for metals once every 3 years and (2) there is no state, federal, or Air Force requirement to test for most of the contaminants found in the Phase II study.

At the same time, however, he conceded that (1) some type of periodic monitoring and sampling may be appropriate for all of the contaminants identified in the Phase II study and (2) the base should probably test for metals more frequently than once every 3 years.

The base subsequently tested its drinking water for metals and, when it received the results in late October 1983, discovered that 4 of the 11 wells tested contained metals at concentration levels that exceeded state and EPA standards. Test results showed that four different metals were present in one or more wells at concentrations that exceeded the standards. Two of these metals, lead and cadmium, presented a risk to the health of humans when used continually for drinking or culinary purposes. The other two metals, manganese and iron, are not generally hazardous to health, but may be objectionable to an appreciable number of those drinking the water if the standards are exceeded. Standards for these non-hazardous metals are referred to as Secondary Drinking Water Standards. The following table provides information on the McClellan wells which showed the presence of one or more metals at concentration levels that exceed state and EPA standards.

Metals found in
McClellan's drinking water
As reported in October 1983
(parts per million)

Metal	Standard	Hazardous to health	Detected concentration levels at well number 17	8	28	20
Manganese	.05	No	-	.075	.23	.9
Iron	.3	No	-	-	.75	23.0
Lead	.05	Yes	.14	-	-	.17
Cadmium	.01	Yes	.012	-	-	-

As required by the California Domestic Water Quality and Monitoring Regulations, McClellan notified the DOHS of these results within 7 days after they were received. In addition, as is also required by the Regulations, announcements about the discovery of lead were made both on television and in the local newspaper. According to the base's Chief of Environmental Health, no mention was made in these announcements of the cadmium because the .012 parts per million concentration level found was only slightly higher than the .01 parts per million standard. Furthermore, the official indicated that no mention was made of the iron and manganese because these metals are not considered hazardous to human health and because there is no requirement to make a public announcement when Secondary Drinking Water Standards are exceeded.

The California Domestic Water Quality and Monitoring Regulations require the base to conduct three additional samples within a month in order to confirm the initial test results. As of November 9, 1983, McClellan had conducted one additional sample. According to the base's Chief of Environmental Health, test results from this sample indicated that the concentration levels for both lead and cadmium were found to be below the state and EPA standards.

A second problem with McClellan's current sampling and testing procedures is that the state criteria for 1,1 dichloroethylene is 0.1 ppb; yet, the detection levels used in testing for the contaminant is 0.5 ppb. This means that the state criteria could be exceeded by a factor of nearly five and still not be detected.

The Chief of McClellan's Bioenvironmental Engineering Services pointed out that the action level for 1,1 dichloroethylene was not provided to the base until September 1983 and indicated that he is currently evaluating this problem. He indicated that this evaluation will include (1) an assessment of whether the state criteria is appropriate and (2) a determination of whether there are acceptable laboratory techniques available to achieve the necessary detection levels and, if so, the estimated cost of using these techiniques.

A final reason why the McClellan sample results cannot be used to completely assess the health risk is that neither state nor EPA standards exist for some of the contaminants that have been identified in McClellan's water. More than a dozen contaminants fall into this category. A related problem is that there is no known way to assess the additive or synergistic effect of all the VOCs, acid compounds, base/neutral compounds, pesticides/herbicides, and metals that have been found in McClellan's groundwater.

MCCLELLAN'S EFFORTS TO IMPROVE OFF-BASE WATER SUPPLIES

McClellan's off-base response actions will be accomplished in accordance with the guidance contained in the EPA/DOD Memorandum of Understanding (see p. 12). The base has already advised State and local regulatory agencies that the Air Force will finance the off-base response action. In addition, at McClellan's request, the EPA has agreed to serve as a technical advisor.

The initial step in McClellan's off-base response action, a one-time sampling of city and domestic wells on the base's western and southern boundaries, has already begun. McClellan has provided $20,000 for the analysis of water samples taken by the Regional Water Quality Control Board and County Health Department.

As of October 14, 1983, samples from 88 off-base wells had been tested. The test results disclosed the presence of eight VOCs and showed 7 of the 88 wells contained a VOC at a concentration level that exceeded the state's action level. This information is summarized in the following table.

Summary of McClellan's off-base sampling results

Contaminant	Action level (ppb)	High reading (ppb)	Contaminant present (number of wells)	Concentration level above the action level (number of wells)
Methylene Chloride	40.0	3.4	22	none
1,1 Dichloroethylene	.1	59.0	5	5
1,1 Dichloroethane	none	12.0	2	none
1,2 Trans-Dichloroethylene	none	42.0	3	none
1,2 Dichloroethane	1.0	1.6	2	1
Chloroform	100.0	.9	8	none
1,1,1 Trichloroethane	300.0	2.3	11	none
Trichloroethylene (TCE)	5.0	8.5	16	1

The contaminant 1,1 Dichloroethylene is one of five VOCs that were identified in the base's drinking water in November 1979 and more recently in off-base testing. During the Phase II study, this contaminant was found in base monitoring wells in concentrations ranging up to 63,000 ppb. To put this number in perspective, the high reading of 59.0 ppb that was found during the recent off-base sampling equates to nearly 2,000 times the 1 in 1,000,000 cancer risk level[5] developed by EPA'a Cancer Assessment Group.

As a minimum, the future off-base response action will include (1) constructing several off-base monitoring wells, (2) establishing a continuous program to periodically sample off-base wells, and (3) providing alternative water sources for those who must close their wells. McClellan has agreed to construct the off-base monitoring wells, with the specifics to be developed in conjunction with state and local regulatory agencies. In addition, the Air Force has agreed to provide $20,000 during fiscal year 1984 for a program that will sample approximately 30 off-base wells every 3 months. The base is alsoproviding alternative water sources for those who must close their wells, with the method of providing the water being determined on a case-by-case basis.

We found that private well owners have used different approaches to obtain alternative water supplies. For example, according to an official in the base's Staff Judge Advocate's office

--The Air Force paid $4,187 to an individual who drilled a new well.

--Another well owner hooked up to the city water system, and no claim had been submitted against the government as of November 7, 1983.

--Two well owners have been provided advanced payments of $153 for the purchase and use of bottle water while McClellan officials study chemical test results and possible solutions.

--One well owner installed a filtration system for the well water and no claim had been submitted aganist the government as of November 7, 1983.

--One well owner is being provided water from the McClellan water distribution system.

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[5]The Cancer Assessment Group has estimated that using drinking water with a .03 ppb concentration level of 1,1 dichloroethylene will result in 1 additonal cancer per 1 million exposed population.

The first two of these well owners had to close their wells following testing conducted in late 1979, while the remaining owners discovered their contamination problems as a result of the most recent testing.

In addition to these individual actions, McClellan must deal with a recent request by the Sacramento City Engineer. This request, submitted on behalf of private citizens residing in an area west of the base, asks McClellan to provide $125,000 for piping and hookup to the city water system. Although tests of wells in this area do not indicate that contaminants are present in concentrations above state action levels, traces of some contaminants have been found in some wells and the private well owners desire city water. This issue was still unresolved as of November 15, 1983.

Possible future off-base requirements include such things as (1) well sealing to prevent contamination in the upper aquifer from seeping into the lower aquifers and (2) taking some action to intercept the spread of contamination. The specific actions to be taken will depend on the results of future monitoring and sampling work.

One additional issue remains unresolved in the area of off-base work. This issue relates to the possibility that McClellan's Camp Kohler laundry may have been the source of the contamination that forced the closure of the Arcade Water District well. District officials have verbally asked McClellan for monetary compensation for the burden placed on the rest of its system by the closure of the contaminated well.

McClellan officials do not believe they should accept this financial obligation because they do not think it is clear-cut that the base laundry caused the contamination. They note that the county sanitary plant is another possible source of the contamination. Because of this uncertainty, the base recently requested that EPA finance and conduct an off-base study to determine the source and extent of the contamination and to develop a recommended response action. This is the approach outlined in the EPA/DOD Memorandum of Understanding for situations where there is no clear evidence that a DOD facility is the sole source of off-base contamination. Under the Memorandum of Understanding, the Air Force would finance the response action if EPA determined that McClellan was the source of the contamination.

As of October 14, 1983, McClellan had not received an answer from EPA.

CONCLUSIONS

Contamination of McClellan's water has been known since 1979. The base has taken action to reduce the amount of contaminants in the drinking water by removing the four most contaminated wells from the water distribution system. They have also increased the amount of testing done to monitor the contaminant content of the drinking water.

Even though test results indicate that the base's water meets state drinking water criteria, we believe that in light of the number and amount of contaminants found in the water during Phase II testing and some more recent tests, McClellan should examine its testing program to determine if there is a need to expand and improve its procedures. Following through on this point should enable McClellan officials to ensure that their water is safe to drink.

McClellan has agreed to take action to test and monitor the groundwater for the areas adjoining the western and southern base boundaries. However, because the direction of groundwater flow has not been decided conclusively, we believe that McClellan should complete its efforts to determine groundwater flow, and if the results so indicate, begin testing in other off-base areas as needed.